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United States Environmental Protection Agency Washington, DC 20460		Work Assignment Number 0-1 Amendment 8			
Work Assignment		[] Original [X] Amendment Number:			
Contract Number EP-C-07-028	Contract Period Base	Title of Work Assignment: Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures			
Contractor		Specify Section and Paragraph of Contract SOW			
Purpose: Work Assignment Initiation [] Work Assignment Close-Out [X] Work Assignment Amendment [] Incremental Funding [] Work Plan Approval		Periods of Performance From: Effective Date To: 06/27/08			
Comments: Amendment 8 to WA 0-1 is an increase in scope covering a response to an on site audit of the contractor on 4/10/2008.					
[] Superfund		Accounting and Appropriations Data			
[] Non-Superfund					
Lin	DC (Max 6)	Budget FY Code/Max	Appropriation Code/Max		
1					
2					
3					
4					
5					
Authorized Work Assignment Ceiling					
Contract Period:		Cost/Fee			
This Action		<h1>Ex. 4 - CBI</h1>			
Total					
Contractor WP Dated:				Cost/Fee	
Cumulative Approved:				Cost/Fee	
Work Assignment Manager: Constance Hart <i>Constance Hart</i> (Signature)		4/16/08 (Date)			
Project Officer Name: Carl Scarbro <i>Carl Scarbro</i> (Signature)		4/16/2008 (Date)			
Other Agency Official Name (Signature)		(Date)			
Contracting Official Name: Tammy A Thomas <i>T. Thomas</i> (Signature)		04/16/08 (Date)			
Contractor Acknowledgement of Receipt and Approval of Workplan (Signature and Title)		Date			

Performance Work Statement

Contract EP-C-07-018	Work Assignment Number 01 Amendment 8
Issuing Office	Environmental Protection Agency 2000 Traverwood Drive Ann Arbor, MI 48105-2498
Contractor	Southwest Research Institute 6220 Culebra Rd. San Antonio, TX 78228-0510
Title	Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures

Purpose:

The purpose of this amendment is to change task 4, 5, 6 and task 7's schedule of deliverables.

Task 1 Work Plan Development

The contractor shall provide a work plan as per Amendment 3. The work plan shall be submitted **not later than** April 25, 2008.

Task 4 Test Fuels and Lubricants

Engine lubricants for this program will be provided by the EPA. They will meet the manufacturer's recommended specifications contained in the owner's manuals. The contractor shall inform the EPA WAM of the volume of lubricant needed in each viscosity grade.

The contractor shall procure and maintain all test fuels for this program. Detailed specification of these fuels is provided in Appendix A.

The test fuels shall be blended exclusively from refinery components and cuts of refinery components. Special chemicals and chemical blendstocks shall not be used. However, butane and benzene may be used to adjust RVP and benzene content of these fuels, respectively. The distillation properties of the test fuels shall meet the following requirements:

- The segments of distillation curves between T10 and T50 shall either be straight lines or slightly convex
- The segments of distillation curves between T50 and T90 shall be concave
- T90 minus T80 shall not exceed 50 deg. F and for nearly all fuels should be lower than 40 deg. F

Furthermore, sulfur content of the fuels may be adjusted using a three-component sulfur mixture containing 4.3 mass % dimethyl disulfide, 22.8 mass % thiophene and 72.9 mass % benzothiophene. All blendstocks used in this program must be approved by the EPA WAM.

All ethanol-containing fuels shall be prepared using denatured ethanol meeting the requirements of ASTM D4806 standard. The properties of all ethanol-containing fuels shall be reported on a total sample basis, e.g. hydrocarbon type content by ASTM D1319 shall be corrected for ethanol content in the fuel. An oxidation inhibitor shall be added to all finished test fuels.

Hand blend inspection data for every test fuel shall be presented to the EPA WAM for review. Final blending shall not proceed unless authorized by the EPA WAM. Similarly, final blend inspection data generated by the blending laboratory (in the event that fuel blending will be subcontracted), and by the contractor, shall be forwarded to the EPA WAM for review prior to the shipment of these fuels for use in this test program. The shipment of the fuels to the contractor and their use in this program shall not proceed unless authorized by the EPA WAM. Once a fuel has been accepted for testing, a 5 gallon sample shall be shipped to EPA for use in an audit and/or a round robin program.

The contractor shall make sure that the quantities of test fuels blended include a reasonable safety margin in case some of the tests must be repeated and shall advise the EPA WAM about the magnitude of that margin. In addition, the blending subcontractor (if any) shall prepare 200 gallons (each) of fuels 17, 18, and 19 beyond what is needed for this program. The additional quantities of these fuels shall be shipped to EPA's facility in Ann Arbor, Michigan, when directed by the WAM.

Upon the receipt of test fuels, the contractor shall conduct a set of analyses listed in Table 4-1 on a single drum sample of each fuel. Additional analyses (to be determined) shall be conducted on a single drum sample of each fuel at the midpoint and at the end of the program to determine if any fuel properties have changed as a result of fuel storage and handling.

Table 4-1. Test Fuel Analyses

Fuel Property	Test Method
Relative Density	ASTM D4052
Ethanol	ASTM D5599
Total Oxygenates Other Than Ethanol	ASTM D5599
Distillation	ASTM D86
DVPE	ASTM D5191
Aromatics	ASTM D1319
Olefins	ASTM D1319
Benzene	ASTM D3606
Sulfur	ASTM D5453
RON	ASTM D2699
MON	ASTM D2700
Hydrogen	ASTM D4808 Method A
Oxygen	ASTM D5599

Detailed Hydrocarbon Analysis	ASTM D6729
Net Heat of Combustion	ASTM D4809
	Please also report C and H by ASTM D5291

The contractor shall utilize fuel storage and handling practices that will minimize, to the greatest extent possible, any changes in test fuel properties or mislabeling of fuel drums, or any other possible situations which could lead to misfueling of the test vehicles. These practices shall include the storage of test fuels in sealed 5B drums, indoors, at temperatures not exceeding 75°F. Furthermore, to assure that no drums are mislabeled, the contractor shall confirm fuel properties listed in Table 4-2 using a Petrospec analyzer each time a new drum is opened. Additionally, unique alphanumeric labels assigned to individual drums shall be recorded each time a vehicle is fueled.

Table 4-2. Test Fuel Properties to Be Confirmed Using the Petrospec Analyzer

Ethanol Content of the Fuel, vol. %	Fuel Properties to Be Confirmed
0 – 15	Ethanol content, aromatic content, T90
> 15	Aromatic content, T90

Similarly, the contractor shall ensure that the fuel blending subcontractor (if any) will apply equally stringent fuel storage and handling practices to finished test fuels waiting for shipment. The contractor shall describe the methods to be employed to minimize such changes, and recommend additional methods that would prevent changes in fuel properties during the test program.

The 5 gallon sample of each test fuel for shipment to the EPA as well as fuel samples needed to perform the analyses listed in Table 4-1 shall be taken by the contractor from drums cooled below 45°F and preferably placed on their sides. Care will be taken to avoid splashing of the fuels during sampling by making sure that the filling tube reaches to the bottom of each container being filled.

The effects of ullage upon vapor pressure of gasoline is to be determined in the following manner: The contractor shall select 5 drums of Fuel 17 (E0) and 5 drums of Fuel 19 (E15) and collect appropriate samples upon initial opening and immediately after the last vehicle has been fueled from a given drum, and measure their RVP(DVPE).

Task 5 Vehicle Preparation

Vehicles shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection of the engine, transmission, axles, exhaust system and tires, and verification that no OBD2 faults are set. Photographs of exhaust system layout shall be taken. The exhaust systems of the test vehicles shall be tested for leaks. Weep holes in the mufflers shall be plugged for the duration of the program. The contractor shall collect and record vehicle information described in Appendix C for entry into MSOD data tables.

Following the inspection, a single FTP test shall then be performed using a baseline fuel (TBD) with bag measurements of THC, NMHC, NO_x, CO, and PM emissions. The results of this initial

test shall be submitted to the EPA WAM for review to determine the vehicle's acceptability as a candidate vehicle for the test program. If accepted by EPA, an approved candidate vehicle may begin mileage accumulation and/or preparations for testing as outlined below.

Each vehicle approved by the EPA WAM shall then undergo initial crankcase oil, oil filter and air filter replacement. Air filters shall only be replaced in used vehicles (vehicles with more than 4,000 odometer miles). Oil and air filters shall be procured by the contractor per manufacturer's recommendations. One of the EPA-supplied lubricants shall be used per the vehicle manufacturer's viscosity requirements.

If the procured vehicle is used (has more than 4000 miles on the odometer), the engine oil and oil filter shall be replaced a second time following a full engine warm-up. The lubricant level in the sump shall be allowed to stabilize and its level indicated on the dipstick shall be recorded. The vehicle shall then be driven 2,000 miles on non-oxygenated, commercial, 87 octane gasoline to condition the lubricant in preparation for the emissions test program. Mileage accumulation shall either be done on a chassis dynamometer using the Standard Road Cycle or the vehicle shall be driven primarily on local interstates at or below posted speed limits.

If the procured vehicle is new (less than 4,000 miles), it shall be driven to 4,000 odometer miles either by operating it on a mileage accumulation dynamometer using the Standard Road Cycle or the vehicle shall be driven primarily on local interstates at or below posted speed limits. The fuel shall be a non-oxygenated, commercial, 87 octane gasoline. At the 2,000 mile odometer reading, crankcase oil and oil filter shall be replaced a second time. To accommodate subsequent oil samples, the sump shall be overfilled by 12 oz. The vehicle shall then be driven to make sure that fresh oil and the remainder of used oil have mixed well in the sump and a 4 oz. sample of oil shall be taken from the engine. The lubricant level in the sump shall be allowed to stabilize and its level indicated on the dipstick shall be recorded. Mileage accumulation will then resume and continue until odometer reading of 4,000 miles is attained.

The oil sample taken at 2,000 miles and all subsequent oil samples shall be shipped in biweekly batches to the following address:

Lubrizol Corporation
1275 Lloyd Road (Bldg 8)
Wickliffe, OH 44092
Attn: Dr. Ewa Bardasz

Following the second oil change, no engine oil shall be added to any test vehicle until the completion of the test program. Should engine oil level in any the test vehicle fall to the minimum mark on the dipstick anytime during this program, the contractor shall immediately notify EPA WAM.

Following mileage accumulation and lubricant conditioning, each new vehicle shall once again undergo thorough inspection of the engine, transmission, axles, exhaust system and tires, and verification that no OBD2 faults are set. At that time, the second 4 oz. engine oil sample shall be taken and shipped to Lubrizol. Used vehicles need not undergo this inspection a second time.

Additional 4 oz. engine oil samples shall be taken and shipped to Lubrizol following emissions testing of the 4th, 14th and 25th fuel in the Phase 3 test sequence of each vehicle, assuming that fuels 1-16 and 20-28 will be tested in each vehicle as one set in a random order.

In the case of the four FFVs, the final oil sample shall be taken following emissions testing on E85 fuel (the last fuel tested in each FFV in Phase 3 of the program). At that time the oil level on the dipstick shall also be recorded.

All engine oil samples shall be taken from warmed up engines, preferably using a Vampire pump. The following information shall be recorded in program files and on the oil sample label to be attached to each sample taken:

- Date
- Test vehicle designation
- Odometer miles
- Designation of exhaust emissions test immediately preceding engine oil sampling, if applicable
- Test oil code

If any test vehicle is equipped with traction control, the contractor shall ensure that the latter is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS)), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.

Road load derivations to generate dyno set coefficients will be performed at 75°F once vehicles have completed mileage accumulation. The test weight (ETW) and target coefficients for each vehicle must be approved by the EPA WAM. For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle including the cold temperature testing.

Task 6 Vehicle Testing

6.1 Basic Testing Protocol

The basic testing protocol is the testing of the recruited vehicles across all the test fuels over the California Unified Cycle (LA92) as a three phase, cold start test at FTP ambient and load conditions. Limited testing shall also be done at 50°F. All tests on a given vehicle must be done using the same 48-inch single roll (or equivalent) electric chassis dynamometer. More than one such dynamometer may be used in this program. The same driver shall also be used for all tests on a given vehicle (for all test repeats and across all test fuels). The contractor may comment on the feasibility of these requirements and propose additional measures that will reduce test to test variability, such as multi-shift testing on fewer chassis dynamometers.

Prior to any emission test conducted in this program, the representative bulk oil temperature in the sump shall be stabilized within $\pm 3^{\circ}\text{F}$ of the nominal test temperature, $50 \pm 3^{\circ}\text{F}$ or $75 \pm 3^{\circ}\text{F}$. The

representative oil temperature is defined in 40 CFR Part 86.232-94.

During tests performed at FTP ambient conditions, intake air temperature and humidity shall be maintained at $75\pm 2^{\circ}\text{F}$ and 75 ± 5 grains $\text{H}_2\text{O}/\text{lb}$ dry air, respectively. During tests performed at 50°F , intake air temperature shall be maintained at $50\pm 2^{\circ}\text{F}$. The contractor shall recommend the intake air humidity setting and tolerance for 50°F emission tests which must be approved by the WAM before 50°F testing can begin.

The emission test program shall be executed in the following sequence:

Phase 1: Fuels 17, 18 and 19 tested in all vehicles at 75°F

Phase 2: Fuels 17, 18 and 19 tested in all vehicles at 50°F

Phase 3: Fuels 1-16 tested in all vehicles at 75°F

In Phases 1 and 2 of the program, the test fuels shall be tested in each vehicle in the following sequence: Fuel 17 (E0) followed by fuel 18 (E10) and then fuel 19 (E15).

In Phase 3 of the program, the order in which the various test fuel and vehicle combinations are to be tested shall be randomized. However, replicate tests of a given fuel in a particular vehicle shall be done back-to-back. Specifically, the vehicle shall be tested twice (3 times if determined necessary per emissions variability criteria provided in Table 6.1-3 below) on a given fuel before moving on to the next test fuel in the matrix. This “back-to-back” testing eliminates the need to repeat additional vehicle preps (steps 1-6 of Table 6.1-1, below) between each replicate test on a given fuel.

The EPA requests that Phase 1 test results be made available as early as possible in the second quarter of 2008. The contractor shall comment on the feasibility of launching and completing Phase 1 of this program in the most expeditious manner.

While it is preferable that Phase 2 of this program be completed immediately following Phase 1, it may also be carried out, as a block, shortly following the launch of Phase 3.

The sequence of events for the testing of an individual vehicle is summarized in Tables 3a and 3b. All vehicles shall be tested two or three times on each fuel at each test temperature (replicate tests). The need for a third test will be determined based on the variability of the previous two replicates (see step 14 in Table 6.1-1, below).

The emissions to be measured and reported are THC, NMHC (by FID), NMOG, NO_x , NO_2 , CO, CO_2 , ethanol, PM, speciated VOCs, N_2O , NH_3 and HCN. The contractor shall comment on the feasibility and cost of incorporating bag (phase) level measurement of ethanol emissions by means of INNOVA photoacoustic analyzer.

More specifically, the following exhaust emission measurements shall be made:

1. Bag (phase) level and composite THC, NMHC, NMOG, CO, CO₂, NO_x, NO₂, ethanol and PM emissions
2. Bag (phase) level speciated VOCs for a subset of tests (See Task 6.2, below). The list of compounds to be measured and analyzed is given in Appendix D Version 2
3. Continuous and integrated by bag (phase) emissions of the following species in raw exhaust: THC, NMHC, CO, CO₂ and NO_x
4. Continuous and integrated by bag (phase) emissions of the following species measured in raw exhaust for a subset of tests (see Task 6.3.2, below): N₂O, NH₃ and HCN

Light-duty FTP weighting factors shall be used to calculate composite emissions. In addition, the contractor shall report bag (phase) level and total test cycle work measured at the wheels.

During all emission tests, the contractor shall record the following OBD 2 parameters at the rate of 1 Hz using contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- Short term fuel trim-bank 1
- Long term fuel trim-bank 1
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- PID \$42 Control Module Voltage
- Purge

The facilities for testing shall meet the requirements of 40 CFR Part 86 Subpart B and 40 CFR Part 86 Subpart C as they apply to vehicle exhaust testing. THC, NMHC, NMOG, NO_x, NO₂, CO, and CO₂, and PM emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO₂ measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the contractor shall describe why that is the case and how it may impact the test results. Variances must be approved

the EPA WAM before testing may begin. The methodology to be used for determining NMHC and NMOG emissions is described in the CARB document “California Non-Methane Organic Gas Test Procedures¹”

The contractor shall insure that sample flow proportionality is verified after each emission test. For PM samples, a proportionality statistic shall be calculated. For other emissions, the contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests conducted at 50°F or 75 °F.

The contractor shall identify, use, and report program external test data as an additional diagnostic to track changes in the analytical and sampling systems used in this program. This shall include, but is not limited to the current CARB laboratory correlation program.

The contractor shall recommend sample collection and analytical methods for non-standard emission measurements. These recommendations will take into account analytical detection limits, emission rates expected of Tier 2 vehicles and the requirement to collect all samples in the course of a single LA92 test. All sample collection and analytical methods related to non-standard emission measurements must be approved by the EPA WAM.

The contractor shall provide a separate cost estimate for “blank” LA92 tests that would be conducted periodically during Phases 1, 2 and 3 of this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH₄, CO, NO_x, CO₂, PM, ethanol by INNOVA, NO₂, VOCs (including aldehydes and alcohols)
- Continuous THC, NMHC, CO, NO_x, CO₂, N₂O, NH₃, and HCN

Two such tests, spaced one week apart, shall be performed at the outset of Phase 1 followed by another test one month later. One “blank” LA92 test shall be conducted at the start of Phases 2 and 3 followed by additional such tests at one month intervals.

6.1.1 Fuel Change and Test Execution Sequence

The contractor shall follow the fuel change and test execution sequence as described in Table 6.1-1, below.

In the course of each phase of EPAct Program, the first two emission tests on a given vehicle and fuel combination shall be performed back-to-back. After two tests have been completed and the acquired data has passed all quality control verifications as described in the contractor’s QAPP, the need for a third test shall be determined by following the variability criteria shown in Table

6.1-3. Specifically, if the ratio of CO₂, NO_x or NMHC results in a pair of tests on a given vehicle and fuel combination exceeds the levels shown in Table 6.1-3, the contractor shall proceed with the third test and promptly notify the EPA WAM, making available the electronic summary reports of the tests in question. The third replicate shall be run the same way as the second. The second and the third replicates shall also be done back-to-back.

Table 6.1-1. Fuel Change and Test Execution Sequence

Step	Description
1	Drain vehicle fuel completely via fuel rail whenever possible
2	Turn vehicle ignition to RUN position for 30 seconds to allow controls to allow fuel level reading to stabilize. Confirm the return of fuel gauge reading to zero
3	Fill fuel tank to 40% with next test fuel in sequence. Fill-up fuel temperature must be less than 50°F for all three Phases of the test program.
4	Start vehicle and execute catalyst sulfur removal procedure described in Appendix C of CRC E-60 Program report. Engine oil temperature in the sump shall be measured and recorded during the sulfur removal cycle.
5	Four vehicle coast downs from 70 to 30 mph shall be performed with the last two measured and monitored in Phases 1 and 2 to establish tolerances for each vehicle for use in Phase 3. In Phase 1 and 2 the coast down time tolerance shall be ±5%. If this is not met then the contractor shall investigate the vehicle for any obvious and gross source of change in the vehicle's mechanical friction.
6	Drain fuel and refill to 40% with test fuel. Fill-up fuel must be at the temperature of the next LA92 test (75 or 50°F)
7	Start vehicle and drive one LA92 cycle. Allow vehicle to idle in park for 2 minutes before engine shut-down
8	Move vehicle to soak area without starting or driving
9	Park vehicle in soak area at proper temperature (75 or 50°F) for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device
10	Move vehicle to test area without starting engine
11	Perform LA92 cycle emissions test
12	Park vehicle in soak area of proper temperature for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device
13	Move vehicle to test area without driving
14	Perform LA92 emissions test
15	Determine whether third replicate is necessary, based on data variability criteria (see Table 6.1-3 below)

16	If a third replicate is required, repeat steps 12, 13 and 14
17	If third replicate is not required, return to step 1 and proceed with next fuel in test sequence

Table 6.1-3. Variability Criteria for Triplicate Testing

Dilute Gaseous Emission	Criteria for requiring a third test (composite cycle emissions)
CO ₂	Ratio of higher / lower > 1.04
NO _x	Ratio of higher / lower > 1.81
NMHC	Ratio of higher / lower > 1.67

6.2 Speciation of Volatile Organic Compounds (VOCs)

VOC speciation shall include C1-C12 hydrocarbons as well as light alcohols, and carbonyls. Sampling and analysis of C2-C12 hydrocarbons will be done using CARB method 1002/1003, "Procedure for the Determination of C2-C12 Hydrocarbons in Automotive Exhaust Samples by Gas Chromatography". Sampling and analysis of alcohols will be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography". Sampling and analysis of carbonyl compounds will be done using CARB method 1004, "Determination of Aldehyde and Ketone Compounds in Automotive Source Samples by High Performance Liquid Chromatography". The contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

During the analysis of C2-C4 hydrocarbons, special consideration shall be given to 1,3-butadiene. Because of the instability of 1,3-butadiene the analysis of C2 – C4 hydrocarbon samples collected during phase 1 of the test cycle shall be initiated within one hour of collection. The speciation of C5-C12 hydrocarbon samples collected in phase 1 of the test cycle shall be completed within 4 hours of collection. The time between sample collection and the start of C2-C4 and C5-C12 hydrocarbon analysis shall be reported. The contractor shall make every effort to complete the analysis of C2-C4 and C5-C12 background hydrocarbon samples on the day they are collected.

Alcohol samples shall be sealed and stored at a temperature below 40°F immediately following collection. The contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

Samples of carbonyl compounds shall be collected in cartridge type samplers. These samples shall be extracted immediately following collection (within 15 minutes) and the extracts sealed and stored immediately at a temperature below 40°F. The contractor shall make every effort to analyze these extracts on the day they are collected, but no later than within three calendar days. This analysis shall account for the presence of a tautomer of acrolein, acrolein-x in the sample. To this end, the contractor shall establish the location of the acrolein-x peak in the HPLC chromatogram and using the response factors derived from the calibration for acrolein, quantify

and report acrolein-x mass emissions.

The contractor shall apply the following daily sequence to vehicle testing:

- All vehicles requiring VOC sampling only during phase 1 of the test cycle shall be tested first
- Any vehicle requiring VOC sampling during all three phases of the test cycle shall be tested last. No more than one such vehicle shall be tested per test day, unless the contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses

The contractor shall also apply the following daily sequence to the analysis of VOC samples:

- VOC samples collected in phase 1 of the test cycle shall be analyzed first, in the sequence of vehicle tests
- If a vehicle requiring VOC sampling during all three phases of the test cycle is tested, the contractor shall analyze the phase 1 sample first, followed immediately by the phase 3 sample and finally by the phase 2 sample.
- Background samples shall be analyzed last, in the sequence of vehicle tests

The VOCs to be analyzed are identified in Appendix D Version 2. The contractor shall comment on the feasibility of these requirements and propose additional measures to improve the precision of VOC speciation. All methods used in the measurement of VOCs must be approved by EPA WAM.

In Phases 1, 2 and 3 of the program, VOC speciation shall be performed for all 3 test phases of the LA92 cycle, on all fuels (3 fuels in Phases 1 and 2, and 16 fuels in Phase 3), for a subset of 3 vehicles (vehicles to be selected by the EPA WAM). This includes all repeat tests, and is outlined graphically in Table 6.2-1, below.

Table 6.2-1: VOC Speciation Summary for 3 Vehicles in Program Phases 1, 2 and 3

LA92 Test Repeat			
LA92 Test Phase (bag)	1	2	3
1	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
2	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls

3	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
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The remaining 16 vehicles shall only require VOC speciation in phase 1 of the LA92 test, also for all test fuels (3 fuels in Phases 1 and 2, and 16 fuels in Phase 3). This also includes all repeat tests and is outlined in Table 6.2-2, below.

Table 6.2-2: VOC Speciation Summary for 16 Vehicles in Program Phases 1, 2 and 3

LA92 Test Phase (bag)	LA92 Test Repeat		
	1	2	3
1	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
2	none	none	none
3	none	none	none

The CARB procedure for calculating NMHC and NMOG (mentioned above and referenced at the end of this document) shall be followed. Phase-level NMOG shall be calculated for all phases where the required measurements are available (i.e. NMHC, carbonyls, and light alcohol measurements are made). In cases where one or more components of the phase-level NMOG calculation is not measured (for example, when carbonyls are not measurement in phases 2 and 3 of some tests) the contractor shall calculate phase-level NMOG mass emissions assuming the missing measurements are below method detection limits. These phase-level NMOG calculations shall then be used to calculate composite weighted NMOG mass emissions. In all cases, the contractor shall report all measured phase-level NMOG components (i.e. each compound quantified) separately along with the associated FID response factors used in NMOG and NMHC determination.

6.3 Continuous Measurements of Gaseous Emissions in Raw Exhaust

6.3.1 Continuous THC, NMHC, CO, CO₂ and NO_x

As Per Amendment 7 with the addition of the following instructions.

The unweighted, integrated mass emissions by phase and for the entire test for the continuous THC, NMHC, CO, CO₂, NO_x, shall be compared to the mass emission values measured by the mechanically integrated (bag) CVS samples. The following maximum deviations from the CVS measurements shall be used as guidelines, until appropriate criteria are developed in Phase 1 of the program:

THC :±15%
NMHC:±15%

CO:±10%
CO₂: ±5%
NO_x: ±10%

6.3.2 Continuous N₂O, NH₃ and HCN

Continuous and integrated by bag (phase) emissions of N₂O, NH₃ and HCN shall be measured using Fourier Transform Infrared Spectroscopy (FTIR) or an alternate method proposed by the contractor and approved by the EPA WAM.

The measurements of N₂O, NH₃ and HCN emissions shall be performed on the first test of each fuel/vehicle combination in Phases 1 and 2 of this program and for the first test on each of the FFVs on E85 in Phase 3. No repeat measurements are required.

Task 7 Schedule of Deliverables is changed as follows:

Schedule of Deliverables

Steps	Duration	Completion Date
Conference call to address outstanding issues	As required	Weekly
Project work plan submission	2 weeks	April 25, 2008
Vehicles accepted by EPA shall begin testing on a rolling basis		Third week April 2008
180 vehicle tests completed, end of current work assignment		June 21, 2008

Work Assignment Manager (WAM)

Constance Hart, 734/ 214-4340

Alternate WAM

Rafal Sobotowski, ASD 734/214-4228

Technical Contacts

Michael Christianson, ASD 734/214-4624

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The above Technical Contacts are able to communicate with the contractor. However it will be technical communication vice technical direction. Per the technical direction clause EPAAR 1552.237-71 of the contract, the PO and the WAM or alternate WAM are the primary representatives of the CO authorized to provide technical direction.

ⁱ “California Non-Methane Organic Gas Test Procedures”. Amended version, July 30, 2002. Available online at the California Air Resources Board website: http://www.arb.ca.gov/msprog/levprog/cleandoc/clean_nmogtps_final.pdf.